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ATTACHMENT A

DECLARATION

I, Richard Craig, Ph.D., declare as follows:

1. I have Bachelor of Science and Master of Science Degrees in Horticulture and a Ph.D. Degree in Genetics from the Pennsylvania State University.
2. I have been a member of the faculty, currently as a Professor of Plant Breeding and The J. Franklin Styer Professor of Horticultural Botany, at The Pennsylvania State University for 39 years.
3. I am the inventor or co-inventor on two Utility Patents and 24 Plant Patents on Pelargonium. A complete list of my publications and patents is attached hereto.
4. The following definitions are provided for reference herein:

A **diploid** is an organism with one pair (two copies) of cytologically identical chromosomes that can pair during prophase of meiosis. Diploids of most organisms exhibit Mendelian (disomic) inheritance. Inbred lines are easy to produce and seed production of inbred cultivars and F1 hybrids are generally possible assuming no barrier to self- or cross-fertilization.

Haploid refers to the gametic chromosome number of a diploid organism. A haploid contains one-half of the number of chromosomes of the parent. In a diploid organism the haploid chromosome set is termed a **genome**; thus all of the genetic information that is representative of the organism is contained in a single genome.

A **polyploid** is an organism with more than one pair of each chromosome i.e., three, four, five, six or more of each chromosome is present; these chromosomes may or may not be cytologically identical. A polyploid may also be a plant of any of the above configurations that lacks or has extra individual chromosomes.

An **autotetraploid** is an organism with sets of four cytologically identical chromosomes that can pair during prophase of meiosis.

The **flower** is the site of all reproductive events in higher plants. Stamens include anthers that are the site of pollen formation. The pistil (stigma, style and ovary) is the site of maternal gamete formation. **Pollination** is the transfer of pollen from an anther to a stigma; **fertilization** is the process of gametic union.

5. A **sexually reproduced plant** is one that is produced from seed derived from the process of double fertilization in which a maternal egg cell (haploid) is fertilized by a paternal sperm cell (haploid) forming the diploid zygote. In a second fertilization, two fused haploid

maternal (polar) cells are fertilized by a haploid sperm cell forming the triploid endosperm, which ultimately serves as a nutritional resource for embryo development and/or subsequent germination events.

The maternal gamete is produced in the ovule of the pistil of the flower and more specifically in the embryo sac that is connected to the maternal tissue at a site called the placenta. The products of the ovule are derived from the maternal (also known as seed, pistillate, female) parent. The most internal tissue of the embryo sac contains the megaspore mother cell. The megaspore mother cell undergoes meiosis to form four haploid megaspores; three of these megaspores disintegrate and the remaining megaspore undergoes endomitotic divisions to form an eight-nucleate (other variations are possible) embryo sac. These nuclei/cells assume specific positions in the embryo sac and three of the nuclei, including the egg cell and two polar cells, are defined by their position.

Pollen is produced in the anthers of the stamens of the flower. Pollen utilized in double fertilization can be derived from either the same parent that contributes the egg (self-fertilization), or from a genetically distinct, unrelated plant (cross-fertilization). The sperm cells are produced from pollen (microspore) mother cells via meiosis to form four microspores, a successive endomitosis to form the vegetative and generative cells, followed by an amitosis to form the two sperm cells.

The zygote undergoes successive mitotic cell divisions to form an embryo. The embryo and endosperm are contained within the embryo sac. The embryo sac is enclosed within one or two integuments; these ultimately become the seed coat (testa). The entire structure is called the ovule; thus a seed is a mature (ripened) ovule

6. **Inbred lines** are normally produced through self-fertilization either of naturally self-fertilized species or through controlled self-fertilization of normally cross-fertilized species. During the process of inbred line development, progeny may be selected for desirable traits of commercial and/or scientific interest. The final seed-produced progeny are uniform for these traits.

Self-fertilization leads to genetic homozygosity (uniformity of alleles at a gene). With each generation of self-fertilization, heterozygosity of plants and genes (each and all genes) is decreased by 50%; conversely homozygosity is increased proportionally. After a certain number (5-7) of generations of self-fertilization, homozygosity of loci and plants approaches 100 % and progeny are phenotypically uniform for most traits.

Breeding progress (with the exception of homozygosity) may be impeded or affected by such phenomena as selection, epistasis (interaction of at least two genes affecting a single trait), linkage (genes segregating together), cytoplasmic inheritance (maternal or paternal influences are not caused by nuclear genes but by genetic elements in chloroplasts or mitochondria), and environmental influences.

Inbred lines may be used as parents of F1 hybrid cultivars. Inbred lines may also be used for inheritance as well as gene mapping studies.

It is crucial to recognize that not all species can be self-fertilized (or continually self-fertilized), that is, in many species inbred lines are not possible either commercially or scientifically. Reasons for lack of ability to self-fertilize may be dioecy (maternal and paternal gametes produced on separate plants), inbreeding depression (the loss of vigor or fertility due to self-fertilization), self-incompatibility (viable pollen which is incapable of fertilizing a plant with similar "incompatibility" alleles), or various gametic and/or zygotic sterilities. In these cases only cross-fertilizations are usually possible.

7. An **F1 hybrid** is the sexually reproduced progeny developed from the cross-fertilization of two inbred parents (true breeding and genetically homozygous for traits of commercial and/or scientific interest). The parents usually have different genetic (allelic) constitutions and the F1 hybrids are heterozygous for all genes that are polymorphic between the two parents. In contrast to the genetic heterozygosity of F1 plants, the progeny thereof are homogeneous in appearance because they share the same genetic constitution. Conversely F1 hybrids will not produce uniform progeny upon self- or cross-fertilization. All genes that are heterozygous in the F1 hybrids (polymorphic between the original parents) segregate in the succeeding generations. Once an F1 hybrid is created, it may also be asexually propagated and cloned.
8. The term **hybrid** can be applied to any sexually reproduced progeny resulting from the cross-fertilization of two or more parents regardless of the origin or genetic constitution of those parents. The parents may be of different genera (intergeneric hybrids), different species (interspecific hybrids), different botanical varieties (intervarietal hybrids), different cultivars, different breeding lines, etc. Hybrids result from double fertilization with the sperm cells (pollen) contributed by one parent and the egg cells contributed by a second parent. With the exception of F1 hybrids and inbred lines, cross-fertilization and indeed self-fertilization of most plants produces heterozygous and heterogeneous progeny. In most instances, every progeny will be different from every other both genotypically (genetic constitution) and phenotypically (traits).

This non-uniformity is normal in species that are **diploid**. Thus, when one makes a cross-fertilization of heterozygous parents, one cannot predict the specific combination of traits in the progeny. When a large number of genes have different allelic combinations in the parents, the possible genotypic combinations in the hybrid progeny approach infinity.

Such genotypic diversity among hybrids is magnified when species are **polyploid** - having more than two identical genomes. Thus, each gene is present in more than two copies leading to an exponential number of phenotypes in the progeny. Many fruit and ornamental plants are polyploid in origin and indeed are polyploid in cultivation. This polyploidy often is accompanied by positive phenotypic characteristics such as larger fruit, improved keeping quality, etc. When these species are cross or self-fertilized, they produce highly heterozygous and heterogeneous progeny. The possible combination of genes is infinite.

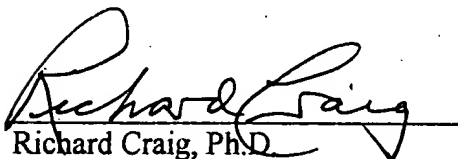
For these reasons, polyploidy and genetic heterozygosity, many cultivars can only be propagated (replicated, cloned) through asexual processes for commercial production.

9. An asexually reproduced plant is produced from cells, tissues, or organs of a mother plant without the process of fertilization. Asexual propagation may occur through cuttings with adventitious roots, physical divisions, runners, layering, grafting, tissue culture, bulbs, corms, tubers, adventitious embryony, and apomixis. Adventitious embryony is the production of embryos from somatic tissues; these are entirely maternal in origin and genetic constitution. Apomixis (parthenogenesis) is the asexual production of seed from solely maternal tissues via specialized processes. When a single progeny or an infinite number of progeny are asexually produced directly from a single mother plant, this is defined as cloning and the progeny are termed clones. With the rare exception of somatic mutations all clones share the same genetic constitution, and are exactly identical to the mother plant.

10. Starting only from a photograph or a written description of a particular cultivar, a plant breeder cannot reproduce the cultivar. No person can independently create through fertilization and hybridization the exact genetic replica of another plant.

Without access to the actual desired plant (or an actual plant of an inbred cultivar or the inbred parents of an F1 hybrid cultivar), the only route to recreating the particular cultivar is to self- or cross-fertilize various parental plants until the desired genotype is somehow recreated. The number of combinations of genes and resulting genotypes from hybridization of diverse parents approaches infinity. Even when the parents of the desired cultivar are known (i.e. the starting materials for recreating the cultivar are known), hybridization thereof still involves the potential for essentially infinite combinations of genes. Hence, such an attempt to recreate a particular cultivar is futile.

11. I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.


Richard Craig, Ph.D.

1/5/02
Date



**LIST OF PUBLICATIONS
AND
OTHER RELEVANT ITEMS
COMPLETED DURING TENURE
AT
THE PENNSYLVANIA STATE UNIVERSITY
BY
DR. RICHARD CRAIG**

PUBLICATIONS

Refereed Journals:

- Craig, R. and D. E. Walker. 1963. The flowering of *Pelargonium hortorum* Bailey seedlings as affected by cumulative solar energy. **Proc. Am. Soc. Hort. Sci.** 83:772-776.
- Snetsinger, R., C. P. Balderston and R. Craig. 1966. Resistance to the two-spotted spider mite in *Pelargonium*. **J. Econ. Entomol.** 59:76-78.
- Craig, R. 1968. Implications of the new genetics in horticultural plant breeding. **HortScience** 3:243-249.
- Henault, R. E. and R. Craig. 1970. Inheritance of plant height in geraniums. **J. Hered.** 61:75-78.
- MacDonald, A. J., J. Root, R. Snetsinger and R. Craig. 1971. Techniques of evaluating host resistance to the two-spotted mite *Tetranychus urticae*. **Melsheimer Entomol. Ser.** 8:1-4.
- Chang, Kuo-Koung, R. Snetsinger and R. Craig. 1972. Leaf characteristics of spider mite resistant and susceptible cultivars of *Pelargonium xhortorum*. **Entomol. News** 83:191-197.
- Eyo, Bassey, R. Snetsinger and R. Craig. 1974. Leaf surface preference of spider mites. **Melsheimer Entomol. Ser.** 14:1-11.
- Hewetsen, F. N., G. M. Greene II and R. Craig. 1974. Peach seedling weed control as part of a *Prunus* stem pitting control system. **HortScience.** 9:588-590.
- Milbocker, D. C. and R. Craig. 1974. Morphology of the American holly shoot and inflorescence. **J. Amer. Soc. Hort. Sci.** 99:555-563.
- Craig, R. 1976. Floricultural plant breeding and genetics in the United States. **Acta Hort.** 63:37-47.
- DeVos, N. E., R. R. Hill, Jr., R. W. Hepler, E. J. Pell and R. Craig. 1980. Inheritance of peroxyacetyl nitrate resistance in Petunia. **J. Amer. Soc. Hort. Sci.** 105:157-160.
- Newhart, Susan R., C. P. Romaine and R. Craig. 1980. A rapid method for virus-indexing the florist's geranium. **HortScience.** 15(6):811-813.
- Grossman, H. H. and R. Craig. 1982. The effect of gamma irradiation on germination and plant morphology of *Pelargonium xhortorum* L. H. Bailey. **J. Amer. Soc. Hort. Sci.** 107:72-75.

- Newhart, Susan R., C. P. Romaine and R. Craig. 1982. Enzyme-linked immunosorbent assay for the detection of tobacco ringspot virus in *Pelargonium xhortorum*. **J. Amer. Hort. Sci.** 107:930-933.
- Grossman, H. H. and R. Craig. 1983. Seed transmission of gamma-radiation induced morphological changes in geranium. **J. Amer. Soc. Hort. Sci.** 108:872-874.
- Gerhold, D. L., R. Craig and R. O. Mumma. 1984. Analysis of trichome exudate from mite resistant geraniums. **J. Chem. Ecol.** 10:713-722.
- Walters, D. S., R. Minard, R. Craig and R. O. Mumma. 1988. Geranium defensive agents III. Structural determination and biosynthetic considerations of the anacardic acids on geraniums. **J. Chem. Ecol.** 14:743-751.
- Wolf, S. J. and R. Craig. 1988. Inheritance of flower and stem color in *Exacum affine*. **J. Hered.** 79:303-306.
- Glicenstein, L. J. and R. Craig. 1989. Observing transmitting tissue and other structures in the pistil by means of a fluorescent stain. **Stain Technology** 64(5):229-231.
- Rytter, Joann L., F. L. Lukezic, R. Craig, and G. W. Moorman. 1989. Biological control of geranium rust by *Bacillus subtilis*. **Phytopathology**. 79(3):367-370.
- Walters, D. S., R. Craig, and R. O. Mumma. 1989. Glandular trichome exudate is the critical factor in geranium pest resistance to foxglove aphid. **Entomologia Experimentalis et Applicata** 53:105-109.
- Walters, D. S., H. Grossman, R. Craig and R. O. Mumma. 1989. Geranium defensive agents IV. Chemical and morphological bases of resistance. **J. Chem. Ecol.** 15:357-372.
- Bridgen, M. P., R. Langhans, R. Craig. 1990. Biotechnological Breeding Techniques for *Alstroemeria*. **Herbertia** 45(1 & 2):93-96.
- Craig, R. 1990. Current status of plant breeding and propagation: Where Are We Going in the Twenty First Century - A United States Perspective. **Acta Horticulturae** 272:23-32.
- Deneke, C. F., K. Evensen, R. Craig. 1990. Regulation of petal abscission in *Pelargonium xdomesticum*. **J. Amer. Soc. Hort. Sci.** 25(8):937-940.
- Walters, D. S., R. Craig and R. O. Mumma. 1990. Effects of the mite resistance mechanism of geraniums on the mortality and behavior of the foxglove aphid (*Acyrtosiphon solani* Kalténbach). **J. Chem. Ecol.** 16:877-886.
- Walters, D. S., R. Craig, and R. O. Mumma. 1990. Fatty acid incorporation in the biosynthesis of anacardic acids of geraniums. **Phytochemistry** 29(6):1815-1822.

- Grazzini, R. A., D. Hesk, E. Heininger, G. Hildenbrandt, C. C. Reddy, D. Cox-Foster, J. Medford, R. Craig, and R. O. Mumma. 1991. Inhibition of lipoxygenase and prostaglandin endoperoxide synthase by anacardic acids. **Biochem. Biophys. Res. Commun.** 176(2):775-780.
- Walters, D. S., J. Harmon, R. Craig and R. O. Mumma. 1991. Effect of temperature on glandular trichome exudate composition and pest resistance in geraniums. **Entomologia Experimentalis et Applicata**. 60:61-69.
- Deneke, C. F., L. J. Glicenstein, K. B. Evensen, R. Craig. 1992. Heritable differences in postproduction quality of *Pelargonium xdomesticum*. **HortScience**. 27(1):55-57.
- Hesk, D., R. Craig and R. O. Mumma. 1992. Comparison of anacardic acid biosynthetic capability between insect-resistant and -susceptible geraniums. **J. Chem. Ecology**. 18(8):1349-1364.
- Yerger, E., R. A. Grazzini, D. Hesk, D. Cox-Foster, J. Medford, R. Craig and R. O. Mumma. 1992. A rapid method for isolating glandular trichomes. **Plant Physiol.** 99:1-7
- Craig, R. 1993. Intellectual property protection of *Pelargoniums*. **HortTechnology** 3(3):284-290.
- Schultz, D. J., R. Craig, D. Cox-Foster, R. O. Mumma and J. I. Medford. 1994. RNA isolation from recalcitrant plant tissue. **Plant Molecular Biology Reporter** 12(4):193-199.
- Grazzini, R. A., D. Hesk, E. Yerger, D. Cox-Foster, J. Medford, R. Craig and R. O. Mumma. 1995. Species distribution of biochemical and morphological characters associated with small pest resistance in *Pelargonium xhortorum*. **J. Amer. Soc. Hort. Sci.** 120(2):336-342.
- Grazzini, R. A., D. Hesk, E. Yerger, D. Cox-Foster, J. Medford, R. Craig and R. O. Mumma. 1995. Distribution of biochemical and morphological characters associated with small pest resistance among cultivars of *Pelargonium xhortorum*. **J. Amer. Soc. Hort. Sci.** 120(2):343-346.
- Schultz, D. J., E. Cahoon, J. Shanklin, R. Craig, D. L. Cox-Foster, R. O. Mumma and J. I. Medford. 1996. Expression of a Δ^9 14:0-acyl carrier protein fatty acid desaturase gene is necessary for the production of Δ^5 anacardic acids found in pest-resistant geranium (*Pelargonium xhortorum*). **Proc. Natl. Acad. Sci.** 93:8771-8775.
- Harman, J., P. Paul, R. Craig, D. Cox-Foster, J. Medford, and R. O. Mumma. 1996. Development of a mite bioassay to evaluate plant resistance and its use in determining regeneration of spider mite resistance **Entomologia Experimentalis et Applicata** 81:301-305.
- Grazzini, R. A., D. S. Walters, J. Harmon, D. J. Hesk, D. Cox-Foster, J. Medford, R. Craig and R. O. Mumma. 1997. Inheritance of biochemical and morphological characters associated

with two-spotted spider mite resistance in *Pelargonium xhortorum*. . J. Amer. Soc. Hort. Sci. 122(3):373-379..

Uchneat, M. S., A. Zhigilei, and R. Craig. 1999. Differential response to foliar infection with *Botrytis cinerea* within the genus *Pelargonium*. J. Amer. Soc. Hort. Sci. 124(1):76-80.

Grazzini, R. A., P. R. Paul, T. Hage, D. Cox-Foster, J. Medford, R. Craig and R. O. Mumma. 1999. Tissue-specific fatty acid composition of glandular trichomes of mite-resistant and -susceptible *Pelargonium xhortorum*. J. Chem. Ecol. 25 (4):955-968.

Uchneat, M. S., K. Spicer, and R. Craig. 1999. Differential response to floral infection with *Botrytis cinerea* within the genus *Pelargonium*. HortScience. 34(4):718-720.

Loehrlein, M. and R. Craig. 2000. Floral ontogeny of *Pelargonium xdomesticum*. J. Amer. Soc. Hort. Sci. 125(1):36-40.

Riseman, A. L. and R. Craig. 2000. Physiological and morphological traits associated with zinc deficiency in *Exacum*. Plant and Soil. 219: 41-47.

Published Abstracts

Craig, R. and D. E. Walker. 1961. The effect of solar radiation on the growth and flowering of geranium (*Pelargonium hortorum*) seedlings. 58th Annual Meeting of the American Society for Horticultural Science. West Lafayette, IN. A.I.B.S. Bull. 11(4):51.

Craig, R. and D. E. Walker. 1963. The inheritance of several characters in the geranium (*Pelargonium hortorum*). 60th Annual Meeting of the American Society for Horticultural Science. University of Massachusetts, Amherst, MA. (In printed program)

Carlson, W. H., S. M. Cohan and R. Craig. 1966. Flower initiation in *Pelargonium xhortorum* as related to foliar mineral content. 17th International Horticultural Congress, College Park, MD. Proc. of the 17th Int. Hort. Cong. 1:217.

Cohen, S. M. and R. Craig. 1966. Chemically induced male sterility in *Pelargonium xhortorum* Bailey and *Allium cepa* L. 17th International Horticultural Congress, University of Maryland, College Park, MD. Proc. of the 17th Int. Hort. Cong. 1:211.

Craig, R. 1968. Implications of the new genetics in horticultural plant breeding. 65th Annual Meeting of the American Society for Horticultural Science. Davis, CA. (In printed program)

Cohen, S. M. and R. Craig. 1970. An investigation of factors related to male sterility expression in *Pelargonium xhortorum* Bailey. 67th Annual Meeting of the American Society for Horticultural Science. Miami, FL. HortScience. 5:344.

- Craig, R. 1974. Genetics of the geranium, *Pelargonium xhortorum*. Ornamental Plant Breeding Workshop, 71st Annual Meeting of the American Society for Horticultural Science. University of Guelph, Guelph, Ontario, Canada.
- Craig, R. 1974. Improvement of floricultural and ornamental cultivars. Symposium on the Use of Plant Introductions in the Improvement of Horticultural Cultivars. 71st Annual Meeting of the American Society for Horticultural Science. Guelph, Ontario, Canada.
- Buswell, G. E. and R. Craig. 1979. Flower color inheritance in tetraploid *Pelargonium xhortorum* Bailey. 76th Annual Meeting of the American Society for Horticultural Science. Ohio State University, Columbus, OH. **HortScience**. 14:409.
- Hanniford, G. G. and R. Craig. 1979. Inheritance of earliness to flower in geraniums *Pelargonium xhortorum* Bailey. 76th Annual Meeting of the American Society for Horticultural Science. Ohio State University, Columbus, OH. **HortScience**. 14:409.
- Hampson, S. H. and R. Craig. 1979. Mutation induction in African violets (*Saintpaulia*) by gamma irradiation. 76th Annual Meeting of the American Society for Horticultural Science. Ohio State University, Columbus, OH. **HortScience**. 14:409.
- Niedz, R. P., J. Boyle and R. Craig. 1979. Mutation breeding of *Exacum affine*. 76th Annual Meeting of the American Society for Horticultural Science. Ohio State University, Columbus, OH. **HortScience**. 14:410.
- Gorzo, D. M., R. Craig and . W. White. 1979. Breeding Calceolaria for efficient pot plant production. 76th Annual Meeting of the American Society for Horticultural Science. Ohio State University, Columbus, OH. **HortScience**. 14:410.
- Craig, R., K. Nichols and B. Gatzke. 1979. Evaluation of culture-virus indexed geraniums. 76th Annual Meeting of the American Society for Horticultural Science. Ohio State University, Columbus, OH. **HortScience**. 14:470.
- Wallner, S. J., R. Kassalen, J. Burgoon and R. Craig. 1979. Pollination, ethylene production and shattering in geraniums. 76th Annual Meeting of the American Society for Horticultural Science. Ohio State University, Columbus, OH. **HortScience**. 14:446.
- Hanniford, G. G., R. Craig, S. Speer and M. Brooks. 1980. Methods for the improvement of *Pelargonium xdomesticum*. 77th Annual Meeting of the American Society for Horticultural Science. Colorado State University, Fort Collins, CO. **HortScience**. 15:53.
- Erb, W. A., R. P. Niedz and R. Craig. 1981. Use of colchiploids in breeding *Exacum affine* Balf. 78th Annual Meeting of the American Society for Horticultural Science. Atlanta, GA. **HortScience**. 16(3):454.

- Gorzo, D. M. and R. Craig. 1981. Breeding of *Calceolaria herbeohybrida*. 78th Annual Meeting of the American Society for Horticultural Science. Atlanta, GA. *HortScience*. 16(3):454.
- Hanniford, G. G., G. Metzler, F. Rausch and R. Craig. 1981. Prediction of time to flower of hybrid geraniums. 78th Annual Meeting of the American Society for Horticultural Science. Atlanta, GA. *HortScience*. 16(3):447.
- Hanniford, G. G. and R. Craig. 1982. Genetic studies of early flowering in *Pelargonium xhortorum*. 79th Annual Meeting of the American Society for Horticultural Science. Ames, IA. *HortScience*. 17(3):515.
- Sumanasinghe, A. and R. Craig. 1983. Inheritance of leaf shape, flower shape, flower color and stem color in *Exacum affine* Balf. 80th Annual Meeting of the American Society for Horticultural Science. McAllen, TX. *HortScience*. 18(4):610.
- Deneke, C. F., K. B. Evensen and R. Craig. 1984. Postharvest quality of *Pelargonium xdomesticum* as influenced by production environment. 81st Annual Meeting of the American Society for Horticultural Science. Vancouver, British Columbia, Canada. *HortScience*. 19(3):567.
- Craig, R. 1986. Breeding pelargoniums. Ornamental Plant Breeding Workshop. 83rd Annual Meeting of the American Society for Horticultural Science. Davis, CA.
- Craig, R. 1987. Breeding improved cultivars of regal pelargonium. Ornamental Plant Breeding Workshop. 84th Annual Meeting of the American Society for Horticultural Science. Orlando, FL.
- Grazzini, R. A., R. Craig and R. O. Mumma. 1990. Genetics and biochemistry of insect and mite resistance in geranium. *HortScience*. 25(9):177.
- Grazzini, R. A., D. S. Walters, J. Harmon, R. Craig and R. O. Mumma. 1991. Inheritance of morphological and biochemical characters associated with pest-resistance in geranium. *HortScience*. 26(6):781.
- Grazzini, R. A., D. Hesk, E. Yerger, C. C. Reddy, G. Hildenbrandt, J. Medford, D. Cox-Foster, R. Craig, R. O. Mumma. 1991. Inhibition of prostaglandin endoperoxide synthase and lipoxygenase by anacardic acids. *HortScience*. 26(6):781.
- Grazzini, R. A., E. Yerger, D. Hesk, D. Cox-Foster, J. Medford, R. Craig and R. O. Mumma. 1991. Glandular trichome-specific lipid composition of geranium. *HortScience*. 26(6):783.
- Riseman, A. L., R. Craig. 1995. Interspecific *Exacum* hybrids — novel germplasm for the production of a new floricultural crop. 18th EUCARPIA Symposium on Ornamental Plant Improvement (Section: Ornamentals). *Proceedings*. pp. 39.

- Hage, T. G., D. Cox-Foster, R. Craig, J. I. Medford and R. O. Mumma. 1995. Characterization of proteins and enzymes associated with resistance to small arthropod pests in *Pelargonium xhortorum*. 1995 Biochemistry and Molecular Biology of Plant Fatty Acids and Glycerolipids Symposium, South Lake Tahoe, CA P-204.
- Schultz, D. J., D. Cox-Foster, R. Craig, R. O. Mumma and J. I. Medford. 1995. Isolation and characterization of a unique C16:0-ACP fatty acid desaturase from *Pelargonium xhortorum*. 1995 Biochemistry and Molecular Biology of Plant Fatty Acids and Glycerolipids Symposium, South Lake Tahoe, CA O-27.
- Anon, K. M. and R. Craig. 1997. Growth and flowering of interspecific hybrids of Sri Lankan *Exacum* species (Gentianaceae): a challenge in domestication. *HortScience*. 31(4): 597.
- Uchneat, M. S. and R. Craig. 1997. Resistance of *Pelargonium* species to the fungal pathogen *Botrytis cinerea*. *HortScience*. 31(4): 565.
- Loehrlein, M. and R. Craig. 1997. Floral initiation in *Pelargonium xdomesticum* is affected by total cumulative irradiance. *HortScience*. 31(4): 570.
- Riseman, A. and R. Craig. 1997. Physiological differences between zinc-efficient and zinc-inefficient genotypes of interspecific *Exacum*. *HortScience*. 31(4): 571.
- Loehrlein, M. and R. Craig. 1998. Floral ontogeny of *Pelargonium xdomesticum*. *HortScience*. 33:536.
- Loehrlein, M. and R. Craig. 1999. Floral initiation of regal pelargoniums grown at varying daily light integrals. *HortScience*. 34(3):539.
- Anderson, L. and L. Wakefield,. 1999. Interaction of genotype and temperature on the floral initiation of *Pelargonium xdomesticum*. *HortScience*. 34(3):556. (Undergraduates advised by E. J. Holcomb R. Berghage, and Richard Craig)
- Murphy, A.M. and R. Craig. 2001.

Non-refereed journals

- Craig, R. 1958. **Hollies**. Penn State Farmer. December Issue.
- Craig, R. and D. E. Walker. 1959. **Geranium seed germination techniques**. *Geraniums Around the World*. 7(2):4-7. (Also 1959. Pa. Flower Growers Bull. 97:1-3.)
- Craig, R. and D. E. Walker. 1960. **Temperature and seedling geraniums**. Pa. Flower Growers Bull. 114:3, 6-7.

- Craig, R. 1962. **Geranium pollination techniques.** *Geraniums Around the World.* 10(2):29-30, 47.
- Craig, R. and G. W. Gorsline. 1962. A computer method of double cross prediction. *Maize Coop. Newsletter.* 36:71.
- Craig, R. 1962. **Geranium varieties.** *Pa. Flower Growers Bull.* 136:7.
- Craig, R. 1962. **Geranium research at Penn State.** *Geraniums Around the World.* 10(2):28.
- Craig, R. 1963. **Cultural hints for growing 'Nittany Lion Red'.** *Pa. Flower Growers Bull.* 153.
- Craig, R. 1964. **'Nittany Lion Red' - new seed grown geranium.** *Science for the Farmer.* 12(1):10.
- Craig, R. 1965. **Geraniums from seed, the breeding program at Penn State.** *Pa. Flower Growers Bull.* 167:1-2, 19.
- Craig, R. 1966. **The greenhouse geranium from seed.** *Gardeners Chronicle.* 159(9):197-198.
- Craig, R. 1967. **Selection for hardiness in *Ilex opaca*.** *Proc. of the 42nd Meeting Holly Soc. of Am.* pp. 7-9.
- Craig, R. 1968. **Past, present and future of seedling geraniums.** *Pa. Flower Growers Bull.* 204:1-2, 7.
- Craig, R. 1972. **Midi-geraniums from seed, soon ready for gardens.** *Science in Agriculture.* 19(2):16.
- Milbocker, D. C. and R. Craig. 1974. **Flowering and fruiting determined for holly.** *Science in Agriculture.* 21(2):10.
- Craig, R. 1976. **Highlights of Penn State research in plant breeding.** *Proc. Ninth International Bedding Plant Conference.* pp. 151-160.
- Craig, R. and S. H. Hampson. 1979. **New African violets created in mutation breeding program.** *Science in Agriculture.* 26(4):12.
- Craig, R. 1980. **Spring in January.** *Horticulture Show Booklet.*
- Craig, R. 1981. **Research continues at Penn State.** *African Violet Mag.* 34(4):4.
- Hanniford, G. G. and R. Craig. 1982. **Genetics of flowering -- geraniums for the future.** *Science in Agriculture.* 29(3):5.

- Craig, R. and J. M. McDowell. 1982. **Genetic studies of *Saintpaulia* A progress report.** African Violet Mag. 35(4):5.
- Craig, R. 1983. **Geraniums for the 80's.** Florists' Review. 173 (4476):21-24. (Reprinted 1984. Geraniums Around the World. 32:8-11.)
- Craig, R. 1983. **21st century geraniums.** New York Times.
- Holcomb, E. J. and R. Craig. 1983. **Producing Exacum profitably.** Greenhouse Grower. 1(11):18, 57.
- Craig, R. and J. M. McDowell. 1983. **Progress Report - Penn State research.** African Violet Mag. 36(4):12.
- Holcomb, E. J. and R. Craig. 1983. **Exacum - A potted plant for the future.** Pa. Flower Growers Bull. 350:5-6.
- Craig, R. and J. M. McDowell. 1984. **Genetic studies of an interspecific hybrid in *Saintpaulia*.** African Violet Mag. 37(4):1984.
- Craig, R. and R. Haldeman. 1985. ***Saintpaulia* research at Penn State.** African Violet Mag.
- Craig, R. 1987. **Annual Flowers.** The Green Scene. July/August, 1987
- Craig, R. 1988. **The impact of biotechnology.** Greenhouse Grower. Vol. 6(1) 26-32.
- Craig, R. 1990. **Breeding: What's impossible today might be commonplace tomorrow.** Greenhouse Manager. Vol. 9 No. 8 p. 69-71.
- Craig, R. 1991. **Viewpoint: Doing the right thing.** Society of American Florists Invited Editorial.
- Craig, R., R. A. Grazzini, R. O. Mumma. 1992. **Genetics and biochemistry of insect and mite resistance in geranium.** Plant Genetics Newsletter. Vol. 8 No. 3 p. 30-33.
- Craig, R. 1995. **Realities and Myths: Zonals versus Hybrids.** Spectrum-Oglevee Ltd. (February Issue).
- Craig, R. 1999. **Once upon a time in the development of new geraniums.** Ohio Florists' Association Bulletin (January Issue, number 831).

Chapters in Books

- Craig, R. and D. E. Walker. 1961. What is in your future - Commercial geraniums from seed? **In: Geraniums, A Penn State Manual.** J. W. Mastalerz, ed., pp. 84-92.
- Walker, D. E. and R. Craig. 1961. Breeding, the future of geraniums? **In: Geraniums, A Penn State Manual.** J. W. Mastalerz, ed., pp. 93-99.
- Craig, R. 1966. Plant breeding and the flower seed industry. **In: Bedding Plants, A Penn State Manual.** J. W. Mastalerz, ed., pp. 102-117.
- Craig, R. 1969. A philosophy of rose breeding. **In: Roses, A Penn State Manual.** J. W. Mastalerz and R. W. Langhans, eds., pp.250-260.
- Craig, R. 1971. Cytology, genetics and breeding of the geranium. **In: Geraniums, A Penn State Manual, Second Edition.** J. W. Mastalerz, ed., pp. 315-346.
- Craig, R. 1976. The flower seed industry. **In: Bedding Plants, 2nd Edition.** J. W. Mastalerz, ed. pp. 25-46.
- Craig, R. 1982. Chromosomes, genes and cultivar improvement. **In: Geraniums III.** J. W. Mastalerz and E. J. Holcomb, eds., pp. 380-410.
- Craig, R. and L. Laughner. 1985. Breeding new cultivars of bedding plants. **In: Bedding Plants, Third Edition.** J. W. Mastalerz and E. J. Holcomb, eds. pp. 526-539.
- Craig, R., R. O. Mumma, D. L. Gerhold, B. C. Winner and R. Snetsinger. 1986. Genetic control of a biochemical mechanism for mite resistance in geraniums. **In: Natural Resistance of Plants to Pests, Roles of Allelochemicals.** M. B. Green and P. A. Hedin, eds., American Chemical Society Symposium Series 296:168-176.
- Craig, R. and R. C. Craig. 1988. Zonal geranium cultivars - past, present and future. **In: Tips on Growing Zonal Geraniums.** H. Tayama, ed., Ohio Cooperative Extension Service Bulletin FP-765. pp. 60-62.
- Hesk, D., R. Craig, L. Collins and R. O. Mumma. 1990. Arthropod resistant- and susceptible-geraniums: Comparison of chemistry. **In: Naturally Occurring Pest Bioregulators.** P. A. Hedin, ed., Amer. Chem. Soc. Sym. Series 449:224-250.
- Walters, D. S., R. Craig and R. O. Mumma. 1990. Heritable trichome exudate differences of resistant and susceptible geranium. **In: Pesticides and Alternatives.** J. Casida, ed., Colymbari, Crete, Elsevier Science Publishers, B.V., Amsterdam. pp. 317-327.
- Craig, R. 1992. Intellectual property protection. **In: Geraniums IV: A Penn State Manual.** J.W. White, ed. The Ball Publishing Co., Geneva IL pp. 389-404.

- Craig, R. 1992. Breeding geraniums for 2000 and beyond (Cytology, Genetics, Breeding & Biotechnology of Pelargoniums). **In: Geraniums IV: A Penn State Manual.** J.W. White, ed. Ball Publishing Co., Geneva IL pp. 373-388.
- J. Sheely and R. Craig. 1992. Growing from vegetative propagules. **In: Geraniums IV: A Penn State Manual.** J.W. White, ed. Ball Publishing Co., Geneva IL pp. 103-112.
- Mumma, R. O., R. Craig, D. Cox-Foster, J. Medford, R. Grazzini, E. Yerger, and D. Hesk. 1992. Chemistry, morphology and genetics of small pest resistance in geraniums. **In., Actas: I Simposio Internacional Quimica de Productos Naturales y sus Aplicaciones.** J. A. Garbarino and P. Fiedler, eds. Division Quimica de Productos Naturales, Sociedad Chilena de Quimica. pp. 45-59.
- Craig, R. 1993. Reproduction in Pelargoniums: Significant advances in physiology, genetics and technology. **In: The Proceedings of the Third International Geranium Conference.** R. Craig, ed., The George J. Ball Publishing Company, Batavia, Illinois, USA. pp. 65-70.
- Craig, R. 1993. Extraterrestrial *Pelargoniums*: A view of the 21st century. **In: The Proceedings of the Third International Geranium Conference.** R. Craig, ed., The George J. Ball Publishing Company, Batavia, Illinois, USA. pp. 345-350.
- Mumma, R. O., R. Craig, D. Cox-Foster, J. Medford, H. H. Grossman, R. Grazzini, D. Hesk, D. S. Walters, and E. Yerger. 1993. Biochemistry and genetics of small arthropod resistance in *Pelargonium*. **In: The Proceedings of the Third International Geranium Conference.** R. Craig, ed., The George J. Ball Publishing Company, Batavia, Illinois, USA. pp. 172-184.
- Craig, R. 1993. Genetics and breeding: challenges and economic benefits of genetic improvements in ornamentals. **In: The Proceedings of the New York Governor's Conference on Agricultural Science and Technology.** Richard T. McGuire, Chairman. pp. 257-263.
- Craig, R. 1994. Breeding new cultivars. **In: Bedding Plants, IV.** E. J. Holcomb, ed., The George J. Ball Publishing Company, Batavia, Illinois, USA. pp. 407-424.
- Craig, R. 1999. A breeding wonder. **In: History of U.S. Floriculture – Commemorative Edition of Greenhouse Grower Magazine.** Meister Publishing Company, Willoughby, Ohio. pp. 14-15.
- Craig, R. 1999. The geranium story. **In: History of U.S. Floriculture – Commemorative Edition of Greenhouse Grower Magazine.** Meister Publishing Company, Willoughby, Ohio. p. 23.
- Schultz, D. L., J.I. Medford, D. Cox-Foster, R. Grazzini, R. Craig and R. O. Mumma. 2000. Anacardic acids in trichomes of *Pelargonium*: biosynthesis, molecular biology and ecological effects. **In: Trichomes, Advances in Botanical Research.** Eds: David Hallahan and John Gray. Academic Press, Harcourt Publ. pp. 175-192.

Mimeographed Articles

These are distributed to flower growers and plant breeders, state and federal agencies, university teachers, researchers, extension personnel, students and amateur horticulturists.

Craig, R. Genetics, breeding and related references on *Tagetes* (Marigolds). (2 pages) 1970.

Zagorski, J. S. and R. Craig. Bibliography of *Saintpaulia*. (14 pages) 1975.

Zagorski, J. S. and R. Craig. Bibliography of the genetics, cytology and breeding of *Pelargonium*. (10 pages) 1975.

Zagorski, J. S. and R. Craig. Bibliography on the effects of ethyl methane sulfonate on plants, 1928 - 1974. (15 pages) 1975.

Craig, R. Geranium pollination techniques. (3 pages) Adapted from an article in Geraniums Around the World 10(2):29-30, 47. 1962. Used for plant breeding classes and for television requests in Philadelphia.

Craig, R. Production of geraniums in the greenhouse from seed. (5 pages) Adapted from a presentation to the Cook County Bedding Plant School, LaGrange, IL. 1965.

Craig, R. The future of geraniums. (4 pages) Presented at the Pennsylvania Flower Growers Conference, University Park, PA. 1965.

Craig, R. Seedling geranium trial - 1967. (9 pages) 1968.

Craig, R. Geraniums - 1978. (6 pages) 1978.

Craig, R. 1978 - Hybrid geraniums - greenhouse evaluation. 1979.

Craig, R. 1979 - Geranium trials. (3 pages) 1979.

Craig, R. Summary of outdoor performance of hybrid and culture-virus indexed geraniums in 1979. (4 pages) 1980.

Craig, R. Hybrid geranium evaluations - a summary for 1978, 1979 and 1980. (9 pages) 1980.

PATENTS

Plant Patents: New and distinct cultivars of Pelargonium xhortorum, geranium; except where noted the cultivars were licensed for commercial propagation; none are currently being marketed. Former students are co-inventors on many of these cultivars.

Ben Franklin	PP6218	Juliet (Risque)	PP6654
Paris	PP6219	Misty	PP7350
Cassandra	PP6220	PSU 821**	PP7351
Helen	PP6247	Centennial**	PP7576
Calypso	PP6378	PSU 208**	PP7627
Siren	PP6379	Jubilee	PP8089

**Not licensed

Plant Patents: New and distinct cultivars of Pelargonium xdomesticum, regal Pelargonium. All were licensed for commercial propagation. Former students are co-inventors on many of these cultivars.

Crystal	PP7343	Debutante*	PP10803
Allure	PP7467	Dandy*	PP11697
Majestic	PP7387	Fascination*	Filed 6/99
Flair	PP7620	Symphony*	PP11927
Fantasy	PP7538	Tiara*	Filed 6/99
Splendor	PP7656	Camelot*	Filed 6/00

* Currently commercially available

Process Patents:

Precision Flowering of Regal Pelargoniums

Co-Inventors - J. R. Oglevee (deceased) and R. Craig: United States Patent #4,897,957, February, 1990.

Δ^9 14:0-ACP Fatty Acid Desaturase and Gene Therefor

Co-Inventors: Richard Craig, June I. Medford, Ralph O. Mumma, Diana Cox-Foster, and David Schultz. United States Patent #5,856,157, January, 1999.

Graduate Theses Supervised, Types Of Degrees And Years Granted

Steven M. Cohan Master of Science, 1966
Dissertation Chemically induced male sterility in *Pelargonium xhortorum* Bailey and *Allium cepa* L.

Robert E. Henault Master of Science, 1968.

- Dissertation Inheritance of plant height in the geranium, *Pelargonium xhortorum* Bailey
- Steven M. Cohan** Doctor of Philosophy, 1969.
Dissertation An investigation of causal factors related to the expression of male sterility in *Pelargonium xhortorum* Bailey.
- Daniel C. Milbocker** Doctor of Philosophy, 1969.
Dissertation Morphology and physiology of flowering in American holly, *Ilex opaca* Aiton
- Kathryn T. Andersen** Master of Science, 1971.
Dissertation The behavior of powdery mildew conidia (*Erysiphe cichoracearum*) on the leaves of *Zinnia elegans* and *Zinnia angustifolia*.
- Robert E. Henault** Doctor of Philosophy, 1972.
Dissertation The morphology of the somatic and pachytene chromosomes of *Pelargonium x hortorum* Bailey.
- Hazell Reed** Master of Science, 1974.
Dissertation Germination of geraniums (*Pelargonium x hortorum* Bailey) as influenced by temperature, media, soluble salts and pH.
- Blair L Winner** Master of Science, 1975.
Dissertation Inheritance of resistance to the two-spotted spider mite, *Tetranychus urticae* Koch, in the geranium, *Pelargonium x hortorum* Bailey.
- Leon J. Glicenstein** Master of Science, 1975.
Dissertation Attempted development of a triploid *Pelargonium x hortorum* Bailey.
- N. Curtis Peterson** Master of Science, 1975.
Dissertation Peroxyacetyl nitrate resistance in Petunia (*Petunia hybrida* Vilm.).
- Virginia S. DeArmond** Master of Science, 1976.
Dissertation A virus-vector relationship in *Pelargonium x hortorum* Bailey.
- Neal E. De Vos** Master of Science, 1977.
Dissertation The inheritance of peroxyacetyl nitrate (PAN) resistance in Petunia (*Petunia hybrida* Vilm.).
- Gordon E. Buswell** Doctor of Philosophy, 1978.
Dissertation Flower color and anthocyanin inheritance of tetraploid *Pelargonium x hortorum* Bailey.

- Steven H. Hampson** Master of Science, 1978.
Dissertation Mutation induction on *Saintpaulia* by gamma irradiation.
- Susan K. Williams** Master of Science, 1978.
Dissertation Inheritance of flower color in *Pelargonium x hortorum* Bailey.
- Beverly A. Gatzke** Master of Agriculture, 1978.
Dissertation Propagation characteristics of gamma radiation-induced mutants in *Saintpaulia* species.
- Glenn G. Hanniford** Master of Science, 1980.
Dissertation The inheritance of early flowering in the geranium, *Pelargonium x hortorum* L. H. Bailey.
- David M. Gorzo** Master of Science, 1981.
Dissertation Photoperiod and breeding studies with *Calceolaria herbeohybrida*.
- Victor Amoah** Master of Science, 1981.
Dissertation Effect of gamma irradiation on reproductive characteristics of *Saintpaulia*
- Susan T. Wolf** Master of Science, 1982.
Dissertation Inheritance of flower color and stem color of *Exacum affine* Balf..
- Heidi C. Wernett** Master of Science, 1982.
Dissertation Inheritance of orange flower color in the geranium, *Pelargonium x hortorum* L. H. Bailey.
- Jean B. Cox** Master of Agriculture in Horticulture, 1982.
Paper Internship with three horticultural organizations in Pittsburgh, PA.
- V. A. D. Sumanasinghe** Master of Science, 1983.
Dissertation Inheritance of leaf shape, flower shape, flower color and stem color of *Exacum affine* Balf
- Judith M. McDowell** Master of Science, 1984.
Dissertation Inheritance of flower type and flower color in the genus *Saintpaulia*.
- Glenn G. Hanniford** Doctor of Philosophy, 1986.
Dissertation Histochemistry of floral initiation in genetically early and late flowering geraniums as related to irradiance exposure.
- Linda J. Laughner** Master of Science, 1986.

- Dissertation Breeding and evaluation of *Pelargonium* for resistance to geranium rust, *Puccinia pelargonii-zonalis* Doidge
- V. A. D. Sumanasinghe** Doctor of Philosophy, 1986.
Dissertation Electrophoretic, cytogenetic, crossability and morphological studies of *Exacum* (Gentianaceae)
- Leon J. Glicenstein** Doctor of Philosophy, 1986.
Dissertation Genetic and cytological control of seed set in tetraploid geraniums.
- C. Frederick Deneke** Doctor of Philosophy, 1986. Co-Advisor with Dr. Kathleen Brown
Dissertation Genetics and physiology of postharvest quality of regal pelargoniums
- Andrew L. Riseman** Master of Science, 1990.
Dissertation Examination of the morphology and reproductive biology of interspecific hybrids of *Exacum*
- Harriet L. Braun** Master of Science, 1992
Dissertation Response of *Pelargonium* genotypes to *Botrytis cinerea*
- Richard A. Grazzini** Doctor of Philosophy, 1993
Dissertation A biochemical, evolutionary, and genetic model of glandular trichome mediated small pest resistance in *Pelargonium xhortorum*
- Kelly M. Anon** Master of Science 1994
Dissertation Environmental studies on the growth and flowering of interspecific hybrids of *Exacum* species (Gentianaceae) endemic to Sri Lanka
- Tanos G. Hage** Doctor of Philosophy 1995
Dissertation Characterization of proteins and enzymes associated with resistance to small arthropod pests in *Pelargonium xhortorum*
- Perry Paul** Master of Science 1995, Co-Advisor with R. O. Mumma
Dissertation New insights into the chemistry of arthropod resistance in *Pelargonium xhortorum*
- David J. Schultz** Doctor of Philosophy 1996, Co-Advisor with R. O. Mumma and Dr. June I. Medford
Dissertation Molecular and biochemical evaluation of fatty acid desaturase genes that influence the production of anacardic acids
- Andrew L. Riseman** Doctor of Philosophy 1997
Dissertation Ecology, physiology and genetics of zinc nutrition in Sri Lankan *Exacum* hybrids (Gentianaceae)

Michael S. Uchneat Doctor of Philosophy 1997
Dissertation Foliar and floral resistance of *Pelargonium* to *Botrytis cinerea*

Marietta Loehrlein Doctor of Philosophy 1997
Dissertation Floral Ontogeny of *Pelargonium xdomesticum* and Response of
Floral Initiation to Irradiance

Andrea L. Murphy Master of Science
Dissertation Assessment of *Botrytis cinerea* resistance in the regal *Pelargonium*



ATTACHMENT B

PBR Application EU 98/0066 rewritten in form of a U.S. Plant Patent application

VARIETY OF GERANIUM NAMED 'PENSYB'

Botanical classification: *Pelargonium x peltatum*.

Comparison to PEL 595:

Characteristic	Pensyb	PEL 595
Leaf blade base	Partly overlapping	Closed
Leaf blade undulation of margin	Weak	Medium

Plant height: Short

Stem color: Green

Leaf blade: Length: Short to medium

Width: Medium to broad

Base: Partly overlapping

Color: Medium green with no variegation

Zone: Very weak to weak; reddish brown

Margin undulation: Weak

Flowers: Time of beginning of flowering: Early to medium

Quantity of open flowers: Small to medium.

Diameter of largest flower: Medium

Pedicle: Green in middle third; no swelling

Bud shape: Elliptic

Type: Double

Petals: Quantity: Very many

Margin: Entire

Upper petal: Width: Medium to broad

Color: Dark purple-red margin and middle upper side, dark pink-red lower side

Markings: Weak to medium stripes; no white zone at base

Lower petal color: Dark purple-red margin and middle upper side, pink-red lower side; no markings

Inner petal color: Dark purple-red; no markings